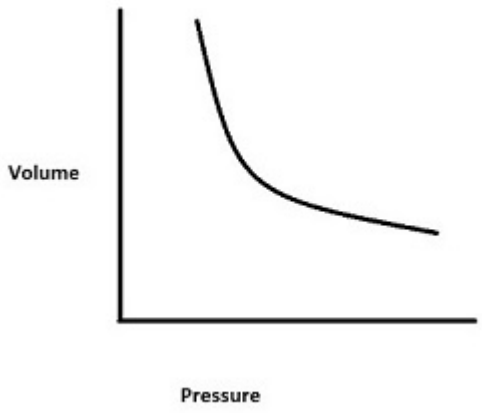
HW 2 PTV

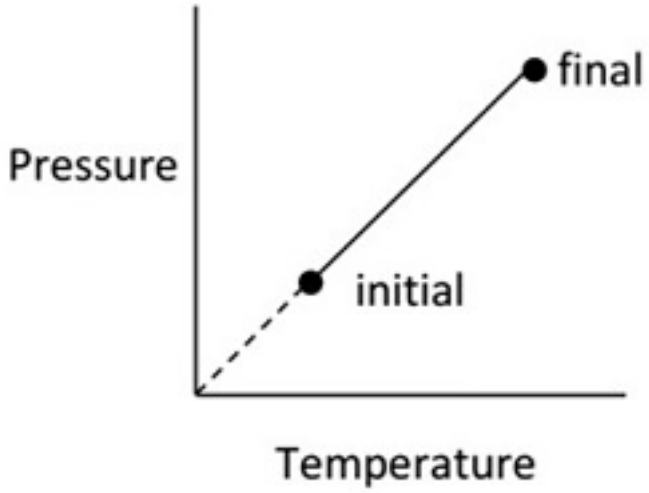
1. On a commercial airline flight you drink most of a bottle of water and then store it in your seat pocket. Just before landing, you take it out again as the flight attendant is collecting trash. The bottle has now collapsed some looking crushed. Using what you know about gas laws, collisions, and forces explain the shape change. (Make sure to describe what happened to ALL variables)

Assuming that you opened the bottle at above the cabin altitude (the altitude at which atmospheric pressure is equivalent to the pressure in the cabin, which is maintained by the airplane's internal systems,) the pressure will be less than that just before landing. Thus, by Boyle's Law, as pressure increases while temperature and number of moles are held constant, the volume of the gas decreases.

Sketch a pressure vs. volume graph of what happened to the bottle as the plane descended.



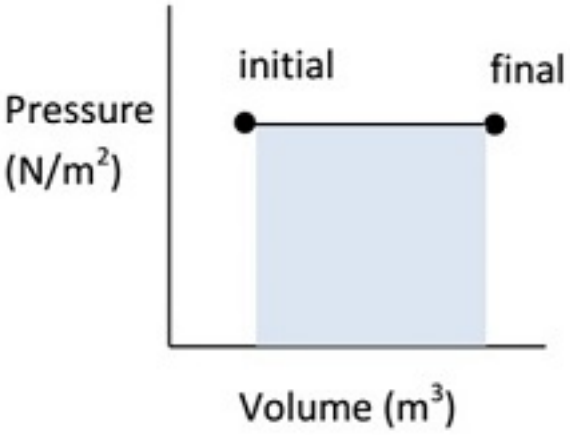
2. A process is represented on a graph in the figure below. Using as much detail as possible, describe what is happening at the molecular level. Provide a practical example of the process.



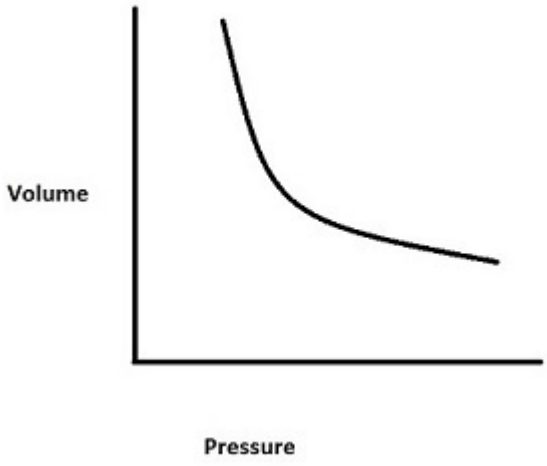
The gas molecules are gaining kinetic energy, as the temperature is increasing. Thus, these molecules are hitting the container more often, creating a larger pressure on the container. An example would be heating a hollow glass ball for some purpose (which makes this practical), in which case the (mostly) rigid, closed ball would be more greatly pressed upon from the inside after being heated.

3. Using the graphing skills you were taught last semester, determine what value the area (the shaded part under the horizontal line) under the pressure v. volume graph represents.

$PV = (\frac{F}{A})(A \times d) = F \cdot d =$Work done to increase the volume while keeping pressure constant



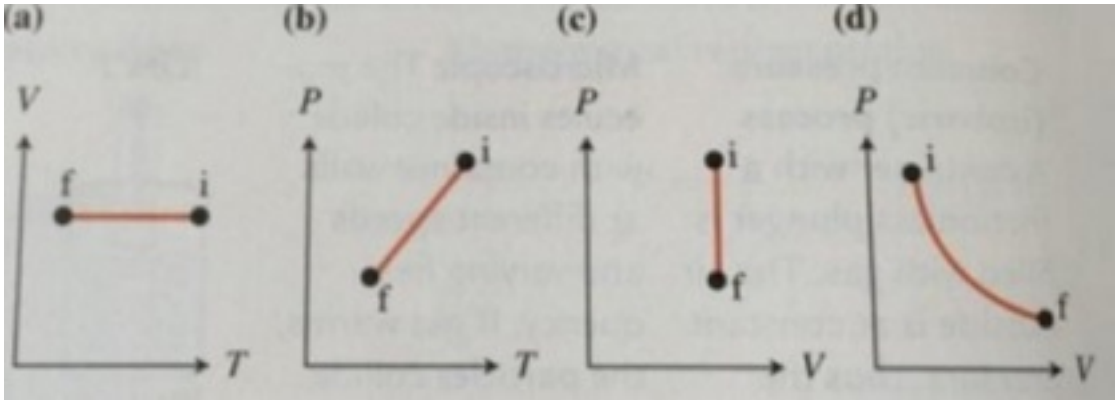
4. A gas is in a sealed container with a heavy top that is free to move. The top moves upward against the constant external pressure pushing down on the top causing the volume of the gas to increase. Sketch the graph of the process below, name the gas law that is represented and write an appropriate mathematical expression.



The direct relation between volume and temperature is described by Boyle's Law.

$PV = constant$

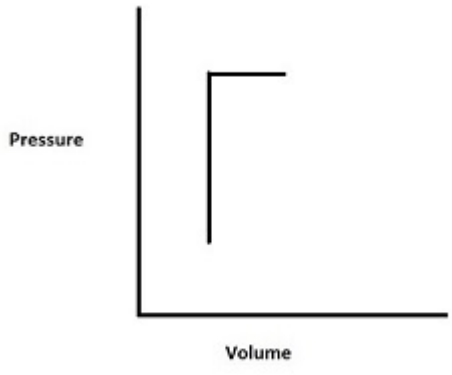
5. A completely closed rigid container of gas is taken from the oven and placed in ice water. Which graph does NOT represent the process? Name the gas law that explains this phenomenon.



Gay-Lussac's Law describes the direct relationship of temperature and pressure.

D isn't appropriate because the volume is in actuality unchanging.

6a. Sketch a pressure vs. volume graph that illustrates the following process: A sealed container of gas is originally at a temperature of T_1, a pressure of P_1, and a volume of V_1. The pressure of the gas is tripled, however the volume of the gas is held constant. Once this new pressure (P_2) is achieved the volume of the gas is allowed to double while keeping the pressure constant at P_2.



6b. As compared to the original temperature of the gas (T_1) what is the new temperature of the gas? EXPLAIN how you determined this answer.

The temperature must triple in the first stage because the pressure triples. The temperature stays the same in the second stage because the pressure stays the same. Thus, the new temperature must be $\boxed{3T_1}$